

L26 ANSWER 17 OF 17 INSPEC COPYRIGHT 2002 IEE  
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 TI Growth of single crystal **GaN** substrate using **hydride vapor** phase epitaxy.  
 AU Naniwae, K.; Itoh, S.; Amano, H.; Itoh, K.; Hiramatsu, K.; Akasaki, I.  
 (Dept. of Electron., Nagoya Univ., Japan)  
 SO Journal of Crystal Growth (Jan. 1990) vol.99, no.1-4, pt.1, p.381-4. 10  
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 Crystal Growth  
 DT Conference Article; Journal  
 TC Experimental  
 CY Netherlands  
 LA English  
 AB **Hydride vapor** phase epitaxy (HVPE) was  
 performed to prepare thick **GaN** films. It is found that (1)  
 surface **treatment** of the sapphire substrate by the Ga+HCl gas  
 just before the growth of **GaN** film reduces the pit density and  
 improves the crystalline quality of the epitaxial **GaN** film, (2)  
 the photoluminescence (PL) spectrum measured at 4.2 K shows the free  
 A-exciton line and a narrow I2 line, indicating that the **GaN**  
 crystals prepared in the study are of high purity and high crystalline  
 quality, and (3) the magnitude of the strain of the homo-epitaxially grown  
**GaN** on a thick **GaN** buffer layer thus prepared is less  
 than half that of a hetero-epitaxially grown **GaN** on sapphire.  
 These results show that high quality, thick single crystals of **GaN**  
 can be prepared homo-epitaxially using **HVPE**.  
 CC A8115H Chemical vapour deposition; A6855 Thin film growth, structure, and  
 epitaxy; A7865J Nonmetals; A7855D Tetrahedrally bonded nonmetals; B0510D  
 Epitaxial growth; B2520D II-VI and III-V semiconductors  
 CT EXCITONS; GALLIUM COMPOUNDS; III-V SEMICONDUCTORS; INTERNAL STRESSES;  
 LUMINESCENCE OF INORGANIC SOLIDS; PHOTOLUMINESCENCE; SEMICONDUCTOR  
 EPITAXIAL LAYERS; SEMICONDUCTOR GROWTH; VAPOUR PHASE EPITAXIAL GROWTH  
 ST photoluminescence spectrum; III-V semiconductor; **hydride vapor phase**  
**epitaxy; thick GaN films; surface treatment;**  
 sapphire substrate; pit density; crystalline quality; free A-exciton line;  
**homo-epitaxially grown GaN; thick GaN buffer layer; 4.2**  
**K; single crystal GaN substrate; Al2O3**  
 CHI Al2O3 sur, Al2 sur, Al sur, O3 sur, O sur, Al2O3 bin, Al2 bin, Al bin, O3  
 bin, O bin; GaN sur, Ga sur, N sur, GaN bin, Ga bin, N bin  
 PHP temperature 4.2E+00 K  
 ET Ga\*N; GaN; Ga cp; cp; N cp; Cl\*Ga\*H; HCl; H cp; Cl cp; Ga+HCl; I2; V;  
 Al\*O; Al2O3; Al cp; O cp; Al2O; Al; O; Ga; N

=>

Handwritten calculations:

$$\begin{array}{r} 80 \\ 80 \\ 32 \\ \hline 192 \end{array} \cdot 80$$

$$\begin{array}{r} 68 \\ 32 \\ \hline 100 \end{array}$$

$$\begin{array}{r} 192 \\ 14 \\ \hline 178 \end{array}$$

$$\begin{array}{r} 12 \\ 28 \\ 32 \\ \hline 154 \end{array}$$

$$\begin{array}{r} 16 \\ 32 \\ 76 \\ \hline 154 \end{array}$$